

Thousands protest U.S. policies

by Steven Yudin

OTTAWA — Several thousand chanting demonstrators confronted United States President Ronald Reagan on Parliament Hill yesterday to protest American military aid to the protesters she "demands and other American policies."

A representative of the El Salvadorean Revolutionary Democratic Front (FDR) told the protesters she "demands that Prime Minister Trudeau take a clear position in his talks with Mr. Reagan today and denounce American intervention in El Salvador."

Several speakers appealed to Trudeau to condemn the intervention as the marchers shouted "Hands off El Salvador". One person burned an American flag.

"Some people say it (the FDR) is a communist conspiracy. We say it is a liberation movement," said Father Chisholm, a Catholic priest who spoke at the demonstration.

"Let the people of El Salvador have the right to their own self-determination. Listen to the voices of support for the FDR from President Portillo of Mexico, Chancellor Helmut Schmidt of Germany, Willy Brandt, leader of the Socialist International, and other European, Asian and African leaders. By taking such a stand, you (Trudeau) would be truly representative of Canadian public opinion," he said.

Chisholm noted that the American ambassador to the United Nations, Jeane Kirkpatrick, said United States policy in Latin America should be restructured in order to clear away the emphasis on human rights and other intellectual debris."

Ed Broadbent, leader of the New Democratic Party, told the protesters that Canada should condemn the "increased American aid which continues to terrorize the El Salvadorean population."

"(Canadian External Affairs

Minister MacGuigan) says we'll acquiesce. We will not acquiesce. We are wrong today when we stand by and ignore the American aid to the junta," he said.

Broadbent called for improved assistance to Third World countries and a policy of opposing all outside interventions in Latin America and elsewhere. He said that Trudeau should join with Mexico to mediate peace in El Salvador. He noted that the United Nations has denounced all arms sales to the junta.

Other demonstrators came to Parliament Hill to protest the Reagan administration's refusal to prevent acid rain from harming the Canadian environment; others came to condemn Canada's participation in the North American Air Defence Command (NORAD).

Speaking on acid rain, N.D.P. Energy Critic Evelyn Gigantes said: "This rally demonstrates that we may love a people but we do not love what they are doing to our environment. And we're not going to stand for it."

Diane Beckett of the Toronto-based Pollution Probe said 50 percent of the acid rain that falls on Canada originates in the United States and that the only reference Reagan has made to it is in discussion of easing up present regulations.

"Acid rain makes buildings crumble, affects the logging industry, the tourist industry

continued on page 4



Thousands of people, including three busloads of McGill students, turned up on Parliament Hill yesterday to protest and to see whether Ronnie Reagan dyes his hair black or his face orange.

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Canada's Only Students' Daily

The McGill Daily

New athletic fee challenged

by Kimberley Stephenson

The "No" Committee for athletic facilities referendum has registered an official challenge with the Judicial Board, asking that the March

4th results be declared invalid, and that a new referendum be held in the fall.

Students voted by a wide margin to have a special \$15 per year fee collected for ten

years to be used toward building new athletic facilities.

Terje Anderson, vice-chairperson of the No Committee said the committee was challenging the results on three grounds.

The first challenge is based on the contention the referendum questions did not accurately reflect the complete motion passed by Students' Council.

"The question did not reflect the fact that the money could go back to the Students' Society," said Anderson.

In response, Debbi Shapiro, Science representative to Council, said any problems with the referendum question should have been challenged before the referendum.

The second part of the challenge is based on a statement made by the Yes Committee in the Daily the day of the referendum which reads:

"In a February 4th letter to the Students' Athletic Council and the Students' Society, Principal Johnston wrote that the Senate Committee on Physical Development has guaranteed \$7 million for the combined renovation and construction of McGill's athletics facilities, to begin this year."

However, the letter from Johnston clearly states that \$3 million has been approved for

continued on page 4

Grads elect engineer as new prez

by George Cook

Andy Haber, a chemical engineering student about to begin work on his PhD, has become president of the Post Graduate Students' Society (PGSS) council for 1981-82.

Haber, who was unopposed for the presidency, currently serves on the PGSS council executive.

In a brief interview Monday,

Haber said he is concerned about the plight of McGill's foreign graduate students. He said he wants to establish contact with new foreign students this summer to help them make the transition to life at McGill.

Haber also said he wants to encourage increased participation by graduate students in the PGSS and the council.

"I'd love council to expand and get a broader base," he said. He also said he has strong feelings about the relationship between the PGSS and the Students' Society but added that he preferred not to elaborate at this time.

"I'd like council and the PGSS to stand for more than just Thomson House — to stand for a lot more," Haber said.

Several other PGSS council executive positions have also been filled by acclamation.

Business Administration student Arlene Segal will be next year's secretary. Dom Del Balso, another MBA student, has been acclaimed director of finance. Jack Sloggett, also in the MBA program, fills the post of vice-president (internal).

There are, however, several contested positions. On March 16 graduate students will be able to vote to fill the positions of vice-president (external) and vice-president (university affairs).

The former is being contested by Elizabeth Lipsz (MBA), Jacques Morin (Classics) and Naeem Rehan (MBA). The latter is being contested by Laura Drover (MBA) and Andre Germalmatos (Classics).

The election will be held March 16, from noon to 4 pm. Ballot boxes will be in the Bronfman, McIntyre, Leacock and McConnell buildings.

Tuition increase sparks occupation

PETERBOROUGH (CUP) —

Thirteen students are occupying the executive offices of Trent University to protest the imposition of differential fees and a raise in tuition, athletics and residence fees.

The students began their occupation at about 10:30 am Monday, and say they will not leave until a "significant number" of their demands are met.

"What we are protesting is not the actual decision to impose differential fees, and athletics, residence and tuition fee hikes," said Paul Knight, student representative to the Board of Governors.

"What we are protesting is the way in which the decision was made."

At a meeting Saturday, the Board raised tuition fees to the maximum level allowed by the Province, and imposed dif-

ferential fees on international students for the first time.

Prior to this meeting, more than 600 students, approximately one-third of Trent's student population, attended a five-hour meeting with Board members to discuss the hikes. The Board then met in a closed session and made the decision.

"The decision was made without any consideration of the discussion with the students," said Knight. "We consider this to be a gross miscarriage of the hitherto accepted democratic procedures of this university."

A group composed of elected representatives and "concerned students," calling themselves SOS (Save Our School) Trent, organized the occupation and have issued a list of demands to the Board.

These demands include the resignation of the Chairperson

of the Board Erica Cherny, the establishment of a part-time students representative on the Board, the addition of a student on the Board's executive committee, and the removal of differential fees until the university community and senate can comment on the matter.

The students are also asking the university to cancel classes tomorrow to allow students to attend a demonstration against tuition increases at the Ontario legislature.

They were also planning to demonstrate when Premier William Davis visited Trent yesterday, and have demanded a public meeting with Ontario education minister Bette Stephenson before March 19.

The executive committee of the Board of Governors were unavailable for comment.

Inside : Daily Science Issue blasts off for outer space!

Staff meeting / screenings

The blood flows today starting at 12:00 in the Daily offices. Come one, come all to help quiz candidates for next year's Editorial Board.

Classified

Ads may be placed through Sadie's, 1st floor Student Union building, 9 a.m. - 5 p.m. McGill students: \$2 per day.

341 - APT., ROOMS, HOUSING

Sublet: large 2 bedroom with exceptionally large kitchen, ideal for 2 or 3 people. Hutchison near gym. Available May 1st to August 31st, option to renew lease. \$335 per month. 844-8157.

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350 - JOBS

Student organization requires part-time experienced typist. Call 842-6816.

352 - HELP WANTED

Needed: Females who suffer from very significant menstrual cramping. Call 842-1231 ext. 729.

Alcohol researchers are looking for people willing to participate in a research study comparing the effects of hormones on alcohol metabolism in males & females. To conclude our study we are interested particularly in women who are using daily estrogen supplements. If you will participate PLEASE call Lori at 286-0359 between 6pm and 11pm.

Needed: a tutor for Kinematics. If interested call Sandra at 481-3811.

354 - TYPING SERVICES

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356 - SERVICES OFFERED

Singers, Players, Listeners, etc.: Do you want a piano accompanist or coach, piano lessons, or help with theory, ear-training or other musical problems. Fully qualified, reasonable rates. Call Peter at 845-3916.

Income tax problems? I'll prepare your Federal return for \$5.00. Provincial for \$2.50 - 13 years experience - call Tom at 273-2301 after 6:30pm weekdays - English ou français.

361 - ARTICLES FOR SALE

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365 - WANTED TO BUY

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367 - CARS FOR SALE

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372 - LOST AND FOUND

Found: a calculator in MC 304 Wednesday. Call Peter at 842-5984 to identify it.

Lost: Women's Timex with white face, roman

numerals, black hands, on Wednesday morning near Sadie's or Centre de Langue Française. If found please call 286-0469.

Found: woman's pair of gloves in the Student Union cafeteria on March 4th. Tell me what they look like and approximately when you lost them, and they're yours. 481-9820.

Lost: light tan leather change purse/wallet in or near the McIntyre Medical Bldg. Wallet and contents of sentimental value. If found please leave at Sadie's or call Tessa at 631-7472.

There was a mix-up at the last Engineering Pub Night in the Student Union...I grabbed the wrong blazer and lost mine. Any info call Sandy at 286-0057.

374 - PERSONAL

Want to talk with a rabbi? Call Rabbi Hausmann at 341-3580.

383 - LESSONS OFFERED

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385 - NOTICES

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McGill Comedy Club: the final meeting of the term is tonight at 7:00 in Union 107. The first 25 people who show up will receive free passes to next term's events.

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Friday, March 20, 1981

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DAILY SCIENCE ISSUE

Shuttle heralds new era in space

by Marc Le Gras

Imagine taking a cylinder approximately three-quarters the size of a jumbo jet and sticking little wings on it. Would you expect such a monster to blast off into outer space just to come gliding back like an 80-ton eagle? It won't be long now before the space shuttle, the most extraordinary piece of space hardware ever conceived, does just that.

What makes the space shuttle system different from any other space vehicle is that it's designed to be reused. The fact that the shuttle is recyclable may one day reduce satellite launching costs by two thirds, a proposition which is music to the taxpayers' sensitive ears. In addition, the American government will now be able to send repairmen to fix high technology satellites that have the audacity to break down.

Seasat is a case in point. The satellite incorporated a new type of radar which fell "silent" shortly after being launched. Had a shuttle been available Seasat could have been retrieved and repaired. Now scientists will have to wait until 1984 for a replacement instrument to be launched.

The shuttle is comprised of an orbiter vehicle which acts as a celestial cargo ship. It incorporates two solid propellant boosters to aid in lifting off, and a large liquid fuel containing tank.

The 21st-century marvel, however, may never have sprouted wings had it not been for the American military's need for easy access to space. The Pentagon may have created the push that got the shuttle out of the realms of science fiction and onto the launching pad.

The shuttle's specifications are extraordinary. The total weight of the shuttle system when fully fueled is four and a half million pounds. The orbiter's engines are capable of delivering roughly three times more power than the Apollo rocket engines. To top it all off, the orbiter will be the fastest vehicle ever designed, reaching speeds of up to 18,000 miles per hour upon reentry. So voluminous is the cargo hold, that if anyone ever wants to send a Greyhound coach into outer space, there will even be a bit of room left over. However, the \$35 million that NASA is asking will make one wish that the shuttle had been reserved in 1977 when the rental was merely \$19 million.

The figure of the greatest magnitude, however, is the cost of the entire project — about \$9 billion! What was once America's dream of the future has now turned into its cosmic headache. Apart from starting off \$3 billion under budget in 1972 the shuttle program has suffered political slaughters, construction delays and designing setbacks that would make any engineer stark raving mad. Not only did NASA contend with a shoestring budget, it also had to cut out the air breathing jet engines which would have permitted the pilots to effect powered landings.

Among the most challenging mechanical problems have been the exploding, cracking, melting, splintering, leaking engines. Problems arose because engines have never been designed for such high operating temperatures. As if engine difficulties weren't enough, 31,000 other nightmares also cropped up: that is to say

the innumerable tight fitting silica tiles which keep on falling off. The silica spun insulation will protect the shuttle from the 2700 degree temperatures reached during reentry. The tiles have caused NASA a great deal of concern since the loss of one well placed tile during reentry could reduce the orbiter to a shower of flames.

The risk of the shuttle mission seems abnormally high. It is for these reasons that NASA has tried to design this celestial vehicle to high "Fail Operational" standards. The fancy safety title refers to the backup systems of the shuttle; many of the shuttle's critical components have been constructed in duplicate or triplicate so that when one system fails the crew simply switches to another.

To avoid any further complications NASA has already trained the first two of the 47 shuttle pilots for over 1000 hours on the most sophisticated simulators ever designed. But there is no substitute for experience, which is one of Commander John W. Young's assets; the May launching of the shuttle will be

space missile bases. Some of the military payloads are so large that only the shuttle would be able to lift them into space.

As one would expect, however, the shuttle has many peaceful applications which could benefit mankind. The media have recently been expounding the fact that better alloys, pharmaceuticals and semiconductors could be manufactured in space. On earth, gravity tends to separate metal mixtures of differing densities. The metal industry feels that in the absence of gravity, the mixtures will not separate upon cooling. Thus better alloys will be possible. The claim of improvements in mixing pharmaceuticals and the manufacture of semiconductors follow these same lines. However, all of these procedures are hypothetical and remain to be proven.

Asked about the likelihood of space industrialization, Watt said: "If the pharmaceutical companies, for example, see that there is money to be made, there could be large scale production in space within 10 years."

the culprit of motion sickness — the otolith organs near the ears. According to Watt, "The shuttle's use won't be optimized until we cure motion sickness."

Although Watt is optimistic, he said, "Motion sickness has been around as long as we have, so we're not assuming



we can completely understand it in a seven-day mission but we can still help reduce the number of cases."

The otolith researchers are preparing for Spacelab 1 in mid-1983, a scientific payload which will also conduct 45 other experiments. One of Watt's duties is to teach astronauts (some of whom by the way have excellent scientific backgrounds) to carry out the experiments. Watt and other scientists must also instruct astronauts in "real time" decision making. Much of the scientific results and data must be analysed on the spot (this is termed "real time") in order that modifications be made to optimize experiments. Communications satellites which have yet to be launched will allow earth-bound scientists to aid the astronauts in crucial decisions.

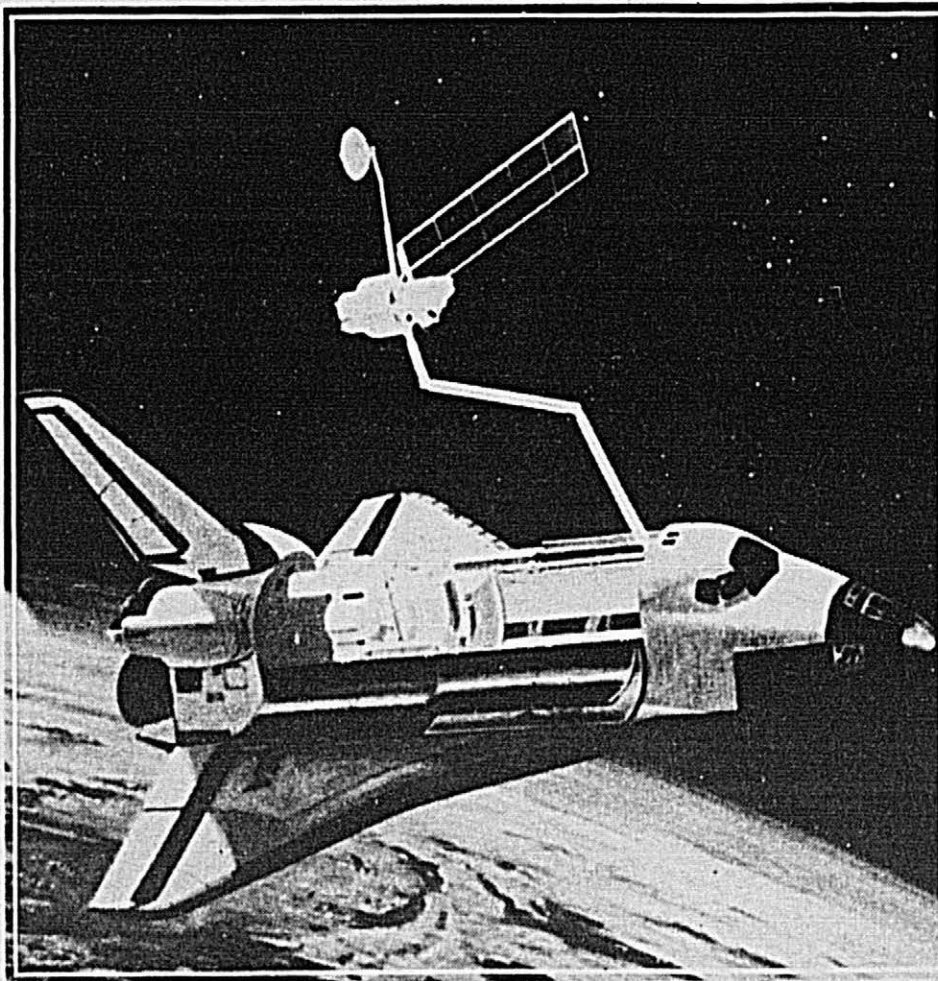
Canada's involvement with the shuttle is strictly technological; the moon will probably turn into blue cheese before a Canadian ever gets near it in an American space vehicle.

However, Canada has quite a few physical scientists involved in the space program. Also, Spar Aerospace of Toronto is building three of the shuttle's \$100-million space arms. CAE Electronics of Montreal have received an \$8.7-million sub-contract from Spar to build the arm's control system. The space arm, or more appropriately named the "Remote Manipulator System," was designed by the National Research Council for moving satellites in and out of the shuttle.

One of the arm's projected manipulations that will make astronomers jump for joy is the launching of the Space Telescope. By placing a telescope into space scientists will now be able to observe light which is normally blocked out by the earth's atmosphere. In addition, the ground controlled telescope will make it possible for us to see a greater volume of space at once. Right now NASA is considering the feasibility of using a Canadian computer eye with the manipulator arm.

Pictures of the shuttle orbiter system may bear a strange resemblance to *Star Wars*, but ironically some of the projected uses of the shuttle may very well create star wars. Though the shuttle's future is uncertain, plans are already being made that would, in Watt's words, "make the shuttle obsolete within 10 years."

As the final countdown winds up and the shining shuttle roars off amidst clouds of vapor, man will once again be advancing his knowledge of the infinite universe that surrounds this tiny planet. Man's eternal gaze to the skies will now focus on this spaceship, a monumental reminder of our need to grasp what may have, up to now, been beyond our reach.



Courtesy Spar Aerospace

his fifth trip into space.

The shuttle pilots spend weekends toying around in a modified Boeing 707 which mimics the orbiter's flying characteristics.

Dr. D. Watt, a member of McGill's Aviation Medical Research Unit working with NASA, told the Daily: "If a complete disaster were to occur, the public would be so stunned that it may not see any more worthiness in the space project. It would remain a political question whether or not it (the shuttle) would fly again."

Watt feels, however, that the military has a major role in backing the shuttle program, that chances are more shuttles will fly.

The new emphasis in warfare seems directed to high power laser or particle beams, spy satellites and possibly even

Whatever offshoots the shuttle may bring, one must keep in mind that the vehicle greatly enhances the possibility of space colonization and exploration.

Dr. Watt's work at McGill, in collaboration with researchers in Toronto and MIT, centers on the problem of motion sickness. Currently, NASA deals with innumerable problems involving space sickness. One can see the disastrous consequences of astronauts becoming sick upon reentry or while in a space suit. So far the only people that have made it into outer space are test pilots — people born with stomachs of steel. The shuttle has created the need for new screening procedures because many passengers in the near future will never have been subjected to zero gravity conditions. Watt and his colleagues are studying

Athletics... continued from page 1

renovation or existing facilities, while \$4 million has been approved in principle for the construction of new facilities.

The letter further states: "Thus until that decision is made I am not in a position to give you a guarantee that a decision to construct new athletic facilities will be made or that even if such a decision were to be made the University would be successful in attracting the necessary funds to build and operate new facilities."

"We did make a mistake,"

said Shapiro.

"We used one sentence instead of two."

"But it's ridiculous that one sentence is such a big issue. The issue isn't how much the university supported the project, the issue was how much the students supported the project," she said.

"Three or seven million is not the point. The point is that the university has given a commitment of some funds," said Lorne Smith, co-chairperson of the Students' Athletic Council.

The third part of the challenge refers to the way the campaign was conducted.

"They had oversize posters in three colours, they had buttons, and they spent more than \$500. The No Committee had \$150 and two days," said Anderson.

There were no set procedures or rules governing the referendum.

"We think it's up to the Judicial Board to see that in the absence of rules, that the spirit and content of rules governing presidential and other elections is upheld," said Anderson.

Shapiro said she will go before the March 18th Council meeting with a proposal that in

the event money collected from the \$15 dollar fee levy is not spent on the construction of new facilities, the Students' Society be compelled to spend it on the renovation of existing facilities.

Reagan...

continued from page 1 and agriculture, yet Americans don't seem to recognize the problem," Beckett told the Daily.

"The purpose of this demo is to bring it to the attention of the U.S. people through the U.S. media."

Several hundred people were also on hand to protest

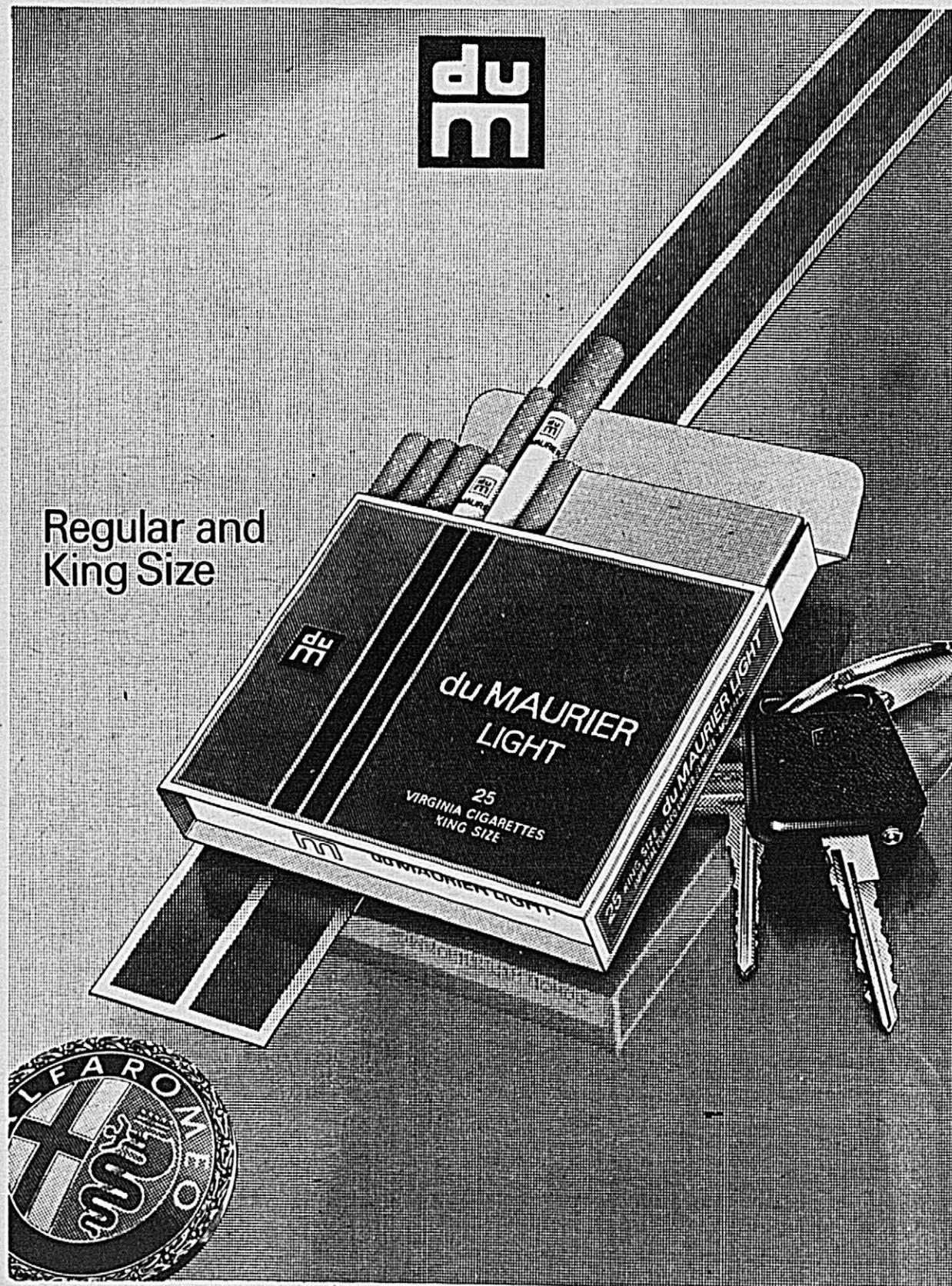
Canada's membership in NORAD. A representative of the Women's International League for Peace and Freedom told the Daily that despite a lack of media attention to the subject, Trudeau would be signing a renewal of the agreement, shortly.

One member of the Ottawa El Salvador Support Committee was arrested by the Ottawa police and charged with "creating a disturbance by shouting" yesterday.

Several protestors made their way to the prime minister's residence to continue the demonstration as Reagan and Trudeau ate lunch.

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Space Law not spaced out

by Bill Sheffield

In a recent interview, Dr. Jean-Louis Magdelenat, of McGill's *Institute of Air and Space Law*, remarked, "When people hear of my interest in Space Law, they say to themselves that the poor fellow must be 'spaced out'."

"Nevertheless, it is a real body of law, which no one seems to expect."

The *Institute of Air and Space Law*, considered a world leader in its field, grew out of the *Institute of International Air Law*, founded in 1951. The "Space" was added in 1968. A part of the Institute is now recognized as a centre for research by the Quebec Government.

Dr. Magdelenat, Associate Director of the Institute, enumerated five international agreements that provide the legal framework of Space Law. The first of these was the Outer Space Treaty of 1967, which forbids the emplacement or orbiting of nuclear weapons on or around any heavenly body. It also identified space as the "common heritage of mankind."

The Treaty was followed by agreements on aid to astronauts in distress, on liability for damage caused by spacecraft, and on registration of all spacecraft launches with the United Nations. Finally, in the Moon Treaty of 1980, it was agreed that any further commercial exploitation of the

Moon would be handled through an international agency under the auspices of the United Nations.

Canadians are well acquainted with the problem of errant spacecraft returning to Earth. In January 1978 the Russian surveillance satellite Cosmos 954 returned to Earth, and its fragments crashed into the Northwest Territories. Because of the nuclear power plant on board, the fragments of the satellite were radioactive, and had to be recovered in order to avoid contamination. Under international agreements concerning spacecraft-caused damage, the Soviets were clearly liable. After months of negotiations, the Department of External Affairs settled for \$3 million out of the original claim of \$6 million. Dr. Magdelenat pointed out that no fault had to be proved in the Canadian case; however, in the more frequent case of satellites colliding in space, fault must be shown before damages may be claimed.

Other cases of damage done by spacecraft on Earth include the 1972 case of a Japanese fishing vessel struck by fragments of a Russian satellite, and the more recent case of the unfortunate demise of a Cuban cow laid low by American satellite debris.

Dr. Magdelenat listed three areas of current controversy in Space Law. They are the control of remote sensing, the

regulation of direct broadcast satellites, and the delineation of national boundaries in space.

"When the Russians orbited Sputnik in 1957, no one complained," said Dr. Magdelenat, referring to the fact that no nation protested that a foreign craft was flying many kilometres above its territory. However, along with the rapid proliferation of satellites, and the realization by the military of the potential for surveillance by satellite, there came advances in remote sensing that altered



Dr. Magdelenat:
The superpowers can no longer act as "dictatorial rulers" of space.

the picture.

Remote sensing refers to the probing of Earth by satellites equipped with infrared scanner, radar, and conventional cameras of high resolution. American remote sensing satellites are supposedly capable of photographing a pack of cigarettes on the ground from their orbits. Moreover, detailed infrared scanning can yield information about a country's crops and produce months before harvest.

Many nations are now protesting American and Soviet surveillance, which is carried out without the prior consent of the observed nation. Some are insisting that agreements be drawn up making higher orbits obligatory for many satellites in order to reduce the invasion of their national privacy.

To many nations, parting with information unwillingly is just as bad as unwillingly receiving it. This is the bone of contention in the controversy over Direct Broadcasting Satellites (DBS).

To illustrate the problem, Dr. Magdelenat chose the following example. Currently, if a television broadcast originating in West Germany is to be seen in Canada, it must be relayed by satellite to a very large dish antenna here, and then disseminated by Canadian broadcasting systems. With a direct broadcast satellite, the same program could be picked

up directly by anyone possessing a small antenna in their homes.

Sidestepping the need for a central receiving antenna also means the avoidance of central control. This alarms some governments, who fear the indiscriminate beaming of foreign culture and ideas into their countries. The international community has split into two camps over the issue, the American camp favoring complete freedom of broadcasting and the Russian camp advocating complete control and prior consent. A Swedish-Canadian proposal suggests that the rule of thumb be prior consent on the basis of negotiation. The onus would be on the receiving nation to prove that the offending emissions were injurious or subversive.

The issue of the delineation of national boundaries beyond the Earth's atmosphere grows out of the debates over remote sensing and telecommunications. An aircraft pilot wishing to cross over into another country's airspace must receive permission. Despite the precedent set by the very first space flights, some nations are now laying claim to some of the space above them. For instance, a group of equatorial states is laying claim to the geostation orbit (a very important equatorial orbit in which a satellite goes around the Earth once a day, thus remaining above one spot on Earth at all times). If current conferences and negotiations lead to an extension of territorial boundaries into space, the delineation of those boundaries will call for an interdisciplinary team of lawyers, geographers and engineers.

Dr. Magdelenat spoke with enthusiasm of the fading bipolarity of space activities, saying, "The situation used to be that of two superpowers, the Soviets and the Americans, acting as dictatorial rulers" of the space field.

Today, China, Japan and Europe have their own launching capability, and the European Space Agency is becoming a force to be reckoned with. Moreover, many international agencies are now in existence that award balance votes to members of the basis of participation. Intelsat and Inmarsat are two prime examples.

While Space Law is not the stuff of which science fiction is currently made, if man moves out to the Moon, or the planets, he will certainly need laws to govern his conduct. A whole host of hypothetical problems wait in the wings, but for the present, Space Law is an authentic branch of law that is certain to grow beyond its already impressive size with the advent of the Space Shuttle, Direct Broadcast Satellites, and the pushing of national boundaries into space.

Military invades space

by Heather Tisdale

Outer space has become another battleground for the superpowers.

In the past few years, science fiction has once again become reality, as ever-more sophisticated and lethal satellites and deterrents have been developed.

Since the Pentagon will be the space shuttle's biggest customer, the launching of the shuttle will only increase the role of the military in space. Although the Pentagon has denied that the shuttle will be used for antisatellite (weapons which destroy satellites) missions, the shuttle is still viewed by the Soviet Union as a threat to its satellites.

Already about 60 percent of Soviet and American satellites are military ones. They are used for military communications, weather prediction and navigation, and also identification of military targets, early warning, and interception and destruction of orbiting satellites. France, Great Britain and NATO also operate military satellites. China has recently emerged as a satellite power, sending up eight satellites since 1970, mostly for systems tests, but also for military observations.

Military reconnaissance satellites are routinely used to check conflict areas such as the Middle East, Cyprus, Turkey and South Africa.

In the near future, satellites will be able to guide lethal weapons to their targets and predict weather conditions to facilitate bombing. They will be able to determine geographical areas

precisely so that no target can be obscured. Satellites will increasingly allow military operations to be controlled remotely.

Furthermore, strategic and tactical warfare could be revolutionized by navigation and geodetic satellites.

The Outer Space Treaty, signed by the U.S., the USSR and 72 other countries, has been made useless by recent advances in conventional space weapons technology. The treaty, signed in 1967, only prohibits nuclear weapons in outer space.

There are two categories of the so-called "hunter-killer" satellites: interceptor/destructor satellites and fractional orbital bombardment systems (FOBS).

FOBS are designed to place a weapon in orbit, and after it has completed its first revolution around the earth, the weapon drops on its target. There is no evidence that the U.S. has designed or tested such a system, but tests of FOBS were carried out by the USSR from 1966 to 1971.

Only the USSR is known to have operational antisatellite weapons. The U.S. Air Force has been testing its antisatellite capability since 1963. President Kennedy referred to antisatellites at this time. However, it is unlikely that American antisatellite systems will be operational before 1982.

The science fiction plot thickens with the addition of lasers to the outer space arsenal.

The laser is potentially one of humanity's most powerful weapons.

American military laboratories have researched its possible uses for the past twenty years, and lasers made their debut on the battlefield in Vietnam, where they were used in the guidance system of the so-called "smart bomb".

The laser's most dramatic military use, however, would be as a "death ray", since the beam of the laser travels at the speed of light. In 1978, *Aviation Work and Space Technology* reported that American military scientists had destroyed a high-speed missile in flight using a powerful type of laser-beam weapon.

The U.S. redirected its energies in 1980 to emphasize high-energy chemical lasers which would defend American satellites and destroy hostile ballistic missiles. It is believed that the USSR is also exploring the use of lasers in outer space.

Last September, U.S. Senator Malcom Wallop remarked, in an understated manner, that "several dozen laser weapons deployed in space would revolutionize the strategic equation as we know it."

Indeed, such weapons would threaten the fragile web of satellites which link the world's communication network.

The issue of potential space warfare makes prospects for detente and disarmament all the more glum, because it is shrouded in secrecy and beset by competition among military scientists to come up with glamorous

continued on page 10

DAILY SCIENCE ISSUE

by Mike Murphy Jr.

As the economic cost of extracting the earth's energy yielding resources becomes exceedingly large, man has begun to turn to space to provide viable solutions to the energy crisis. One promising solution is to have a space colony manufacture solar power stations and send the stations into orbit about the earth. But is space colonization possible? And if so how would the colonies obtain the necessary raw materials to build these power stations? These are some of the important questions under current investigation that have resulted in some not-so-far-fetched ideas.

The main reason for space colonization is to use lunar and other extraterrestrial resources. These resources can be put to use in many ways, such as the construction of solar power satellites and new colonies. Solar satellites produced by the colonies would direct their beams to receiving antennas (rectennas) which would convert the solar energy to direct current electricity, without excessive harmful effects on the environment. The space colonies would then sell this electricity to the world's nations.

But from where will the colonies obtain raw materials? Launching these materials from the earth would be a financial impossibility, since the cost of overcoming the earth's gravity is exorbitant. One way to circumvent this high cost of launching materials from the earth is to acquire as much of the needed materials as possible from the moon, whose gravity is only one sixth that of the earth. These raw materials could then be processed in space by solar powered furnaces into economically valuable products. Thus the keys to establishing a successful space colony would be abundant solar energy and large amounts of lunar material.

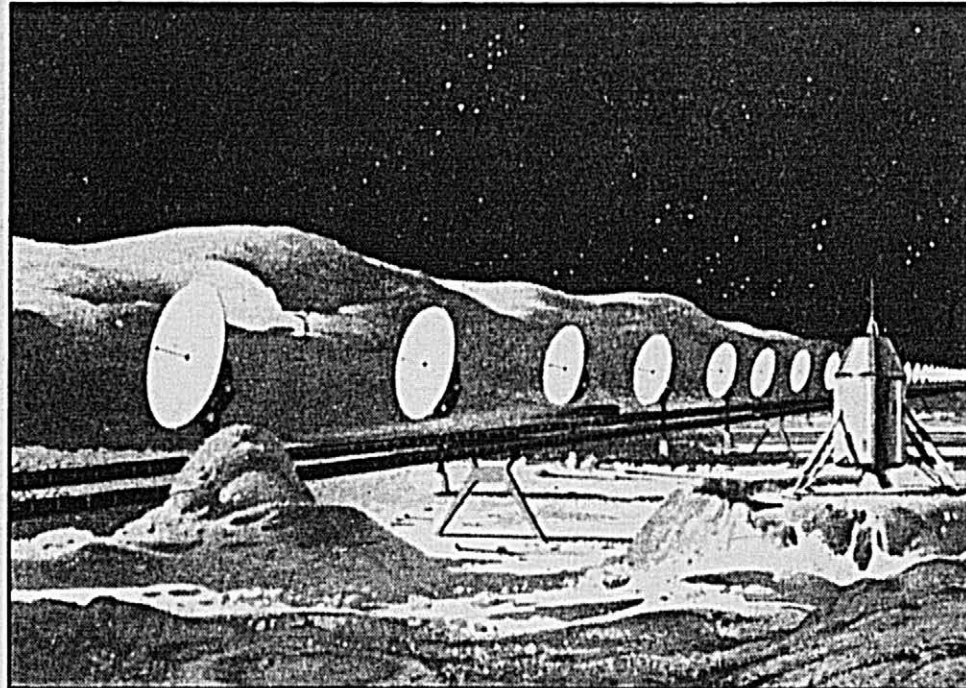
What could the moon provide the colonies with? Even though the lunar rocks are not rich in ores, they still would be adequate for the space colony. From the previous Apollo missions we know that lunar soil contains aluminum, titanium, iron, magnesium and silica. The aluminum, titanium and iron could potentially be used as construction materials. Silica can be used for glass and solar cells, while the oxygen that can be liberated from it can be used for the colony's atmosphere, the manufacture of water and rocket propellants.

The moon can therefore provide the bulk material for large scale industry in space, vastly reducing the amount of material that would have to be lifted from the earth.

The major processing site of lunar materials would be at the colony instead of the moon. The reasoning behind this is twofold. First, since the colony would be closer to the earth less resources and consequently less money would be used in the transportation of the major plant facilities. Secondly the solar furnace power plants that break down the lunar material could only operate half the time on the moon because of the long lunar nights, while the space colony's power plants could run all the time.

Naturally, the moon colony would have to be set up prior to space colonization so that only the essentials need be transported from the earth, with the lunar matter supplying the bulk

Moon Mining: Crater wealth for humanity



Small payloads could be launched from the moon by electromagnetic propulsion along railway-like tracks.

construction ores. The first lunar flights would bring the necessary materials needed at the lunar base to set up and start mining. This would consist of tractors, soil blowers (to cover buildings for protection from solar radiation), several small nuclear power plants (10-50 megawatts) to generate the power needed for the community and launching the materials and other materials needed for the eventual transport of lunar matter. These materials could be delivered to the lunar surface by a space shuttle.

The transport of lunar matter to the space colony involves four aspects: mining the material, launching it from the moon, collecting it in space and moving it to the colony.

All mining of lunar materials would take place on the surface. This easy process consists of scooping up soil and transporting it to the launch area via conveyor belt. At the launch area the material is compacted, and in some cases, 40 pound packages are encased in a fiberglass shell. According to science author T.A. Heppenheimer the amount of material mined per year could be one million tons.

The launching of materials from the moon is the most complex part in the transport of lunar materials. Two possible launching methods have been developed so far. One method is called the Transport Linear Accelerator (T.L.A.) system while the other more simplistic method is referred to as the Gas Gun.

In the TIA system a mass driver launches the material from buckets that travel along railway type tracks. Electricity generated by the nuclear power plants interacts with liquid helium-cooled superconducting magnets on the buckets, to form an "electromagnetic catapult" that causes the buckets to be accelerated to a lunar escape velocity of 2400 metres per second. Initially the bucket is accelerated down the ten kilometre track.

It then undergoes a period of constant velocity. This "passive magnetic damping" steadies the bucket from the oscillations caused by previous accelerations. Next the bucket is realigned by lasers and magnetic coils until it reaches its carefully determined lunar escape velocity and course. Following this the restraining plates drop and the bucket snaps to release its payload. Once the bucket has released its payload it then is decelerated, by trackside linear synchronous motors, and returns to the loading end of the track at the main station. The liquid helium that is used to cool the superconducting magnets is then replenished and the bucket receives its new cargo.

The advantages of this system are that the small payloads used will entail less energy expenditure than the huge power blasts that are needed with larger payloads. The major drawbacks are the precision that is needed and the great dependence on reliability since this system must launch buckets continuously.

The gas gun is the alternative to the TLA system. In this system large payloads are launched through the power liberated when compressed gas is expanded. A launching barrel positioned on the lunar surface would fire large payloads ranging up to 1400 tons.

Compressed hydrogen that is used to propel the payloads is kept in the energy storage system of deep sub-lunar holes lined with heavyweight plastic to conserve the compressed gas.

The hydrogen gas compressor is used to maintain the high pressure that is needed for launching. The average power needed to launch about one million tons per year at lunar escape velocity could be supplied by a nuclear turbine.

The simplicity of this system plus the

fact that its light weight allows for economical transport are its major advantages. The drawbacks of the system are that it disperses materials widely, much like a shotgun. The system also suffers from a less precise trajectory and the need for a specially designed release mechanism. This release mechanism must withstand high pressure while maintaining acceptable leakage rates of the scarce hydrogen gas. These drawbacks make the gas gun much less appealing than the TLA.

Once the materials have been mined and launched, they must be collected in space. Catchers must be located near the moon so as to intercept as much launched material as possible.

So far two types of receptors have been planned for the TLA system. The passive catcher is a large circular disc. It is made of crushable material such as bonded glass wool boards or rigid foam. The lunar matter is "caught" becoming lodged in the disc through sheer impact. Once full, the catcher is towed to the space colony where it is melted down by solar furnaces. The disc material can then be recovered during this process and re-formed in space.

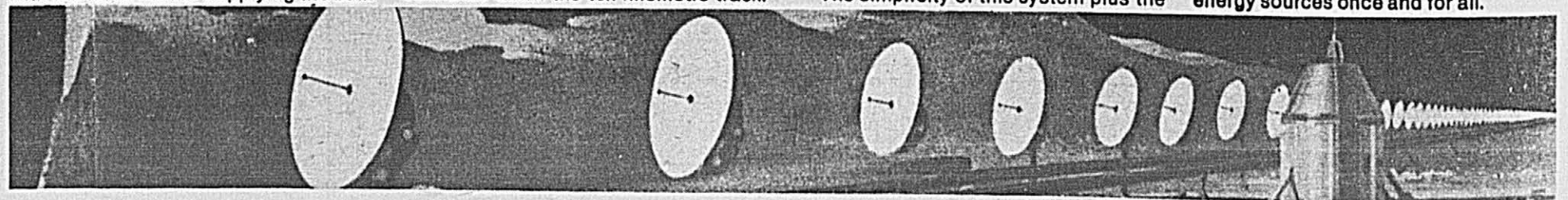
The advantage to this catcher is its simple construction. The major drawback is the catcher's reliance on the precise trajectory of the approaching lunar material. The second system planned by NASA, the active catcher, is a cone shaped structure with a grid of cable across its front which ruptures the fiberglass shell of the lunar payload. This catcher will be about 100 metres wide and 400 metres long. Its inside layer is made of kevlar (the material of bulletproof vests) so it can withstand the impact of the payloads at 200 m/sec. Since it is equipped with a propulsion device and a radar system, it can manoeuvre towards the oncoming material. Once the storage area is full, the catcher is ready for transport. With the propulsion device the catcher can double as a space ore carrier and transport its cargo to the space colony. A nuclear plant will drive the catcher forward by rotating a tube which ejects small rocks directly from the cargo area, much to the delight of Newtonian physicists! It is estimated that about 5% of the mass received would be used as the "propellant".

The gas gun system would require a fleet of fully automated interceptor rockets since it would disperse matter more widely than the TLA system. The major drawback of this system is that expensive earth transported hydrogen fuel must be used. With either system it would take about two months for the catcher to make a round trip from the colony back to its lunar orbit.

Once the lunar material is finally transported to the colony it would be processed and then distributed to needed areas.

It seems evident that the most efficient system would be the TLA launchers together with the active catchers, due to their precision and energy efficiency.

A decade ago this mining process would have seemed to be mere speculation. But due to the current advances in technology, lunar transport has become technically plausible. Thus the mining and transport of lunar material to aid in space colonization could help end man's search for new energy sources once and for all.



Industry gears up for Space

by Bill Skarnes

Skylab and the launching of the space shuttle mark the beginning of a transition from the exploration of space to its exploitation.

This is not to say that we will cease to explore the heavens, since a great deal has yet to be learned. Rather, we are beginning to realize that space may become a valuable resource in the future.

Skylab demonstrated that men and women can live quite happily in space for long periods of time without suffering any ill effects. Small lab experiments were also conducted to investigate the effects of "weightlessness" on certain industrial processes.

For instance, it was discovered that new metal alloys could be made in space that could not be made on the earth's surface. Molten metals of differing densities can be mixed together out in space, because gravitational forces which would otherwise cause the two substances to separate are almost absent.

This is the reason why oil and vinegar

always separate into layers on the kitchen table. In space however, you never have to shake the salad dressing!

Another process enhanced in space is called electrophoresis. It is used to separate materials on the basis of their electrical properties. Its use is illustrated by the manufacture of an anticoagulant drug called urokinase. This enzyme, which is produced by about five percent of the cells in the kidney, will dissolve blood clots almost instantly. This property is very important since thousands of people die from clotting diseases each year. On earth it is very difficult to extract the cells that make the enzyme from the kidney tissue, so culturing the cells becomes very expensive.

In space, however, the cells in a liquid suspension could be isolated very easily, using electrophoretic techniques.

These two and a host of other examples are used by NASA to capture the interest of business in the latest space venture, the nine billion dollar space shuttle.

The space shuttle was originally

built, as its name implies, to bring astronauts and scientists to and from Skylab, where crucial experimentation could be carried out to demonstrate the potential of industry in space.

Unfortunately, Skylab has fallen from the sky. At one point, it was proposed that the space shuttle boost Skylab out of its decaying orbit, but the shuttle program was plagued with delays.

Business is reluctant to invest in the space shuttle because of the lack of useful information. Industry maintains that basic research in space is the government's responsibility, whereas its responsibility is applied research.

In a recent issue of *New Yorker*, a NASA executive said: "Businessmen don't seem to understand that NASA is trying to offer them totally new opportunities. We want to show industry people what space can do — and encourage them to let their minds wander. It's frustrating, for we can see all kinds of potentialities and possibilities, which need all kinds of research, and no industry wants to do it."

In an effort to encourage industry, NASA and the European Space Agency

(ESA) have invested in a smaller version of Skylab known as Spacelab, which is designed to fit in the cargo of the space shuttle. It is in this single-unit laboratory that scientists will conduct future investigations.

Spacelab will set a precedent — for the first time non-astronauts will be allowed to go into space. Once more is learned about space technology, NASA hopes to rent Spacelab missions to industry.

Some industries, such as Grumman and General Dynamics, are not waiting for NASA to take the initiative. Plans are already being drawn up for a space station. Initially, the space stations will be composed of prefabricated modular units similar to Skylab, which will fit into the cargo bay of the space shuttle. Additional modules would be attached to form complexes, some of which will serve as living quarters. Others would serve as workshops or storage facilities.

Electricity to run the space station could be supplied by photovoltaic cells amassed into large solar panels.

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Canada gives shuttle helping hand

by Bev Akerman

Earlier this year, the federal government announced Canada's major contribution to the international space exploration and research effort. At a cost of \$95.4 million, our government is supplying NASA's Space Shuttle Orbiter with its first RMS — Remote Manipulator System — a robot analogue of a human arm.

NASA received the arm on February 11, and has ordered two more.

The space arm is over 50 feet long and 800 lbs in weight, and can carry a load equal in size and mass to a city bus. The arm, which entered the planning stage in 1975, was designed and built in Canada. Research and development is being coordinated by the National Research Council of Canada, with design, construction and testing being managed by Spar Aerospace Products Ltd. in conjunction with CAE Electronics Ltd. of Montreal and Dillworth, Secord, Meagher & Associates Ltd.

The Space Shuttle Orbiter is a revolutionary vehicle: launched into space riding piggyback on rocket boosters, the Shuttle will be used to transport satellites and equipment into space. The RMS will facilitate these journeys by transporting various equipment from the Shuttle's cargo bay into space.

Special engineering problems make the RMS project design challenging. The absence of gravity means that a mass set in motion by one force continues moving until stopped by an opposite force. Every motion generated by the arm must therefore have its opposing counterpart. The absence of an atmosphere as filter means that radiation capable of breaking chemical bonds is continuously present — material must therefore be specially designed with this new environmental hazard in mind. Fluids boil in a vacuum, posing lubrication problems. Temperature extremes are omnipresent. And, most important, human lives are totally dependent on machines in space

— the arm must therefore be highly reliable, and, if it fails, must do so without endangering the lives of the crew, or the Shuttle's ability to return to Earth.

The arm is amazingly dextrous, even in comparison with its human prototype. The resemblance to the human arm is striking. Articulated at the

shoulder, elbow and wrist, with a hand and wire "fingers" capable of grasping, the space arm has a "skin" of thermal blankets to protect the machine from the extreme temperature fluctuations of space and bones of a lightweight carbon composite material. Muscle power is provided by a series of electric motors, and control of the arm is

maintained by the integrated brain power of astronaut and on-board Shuttle computer.

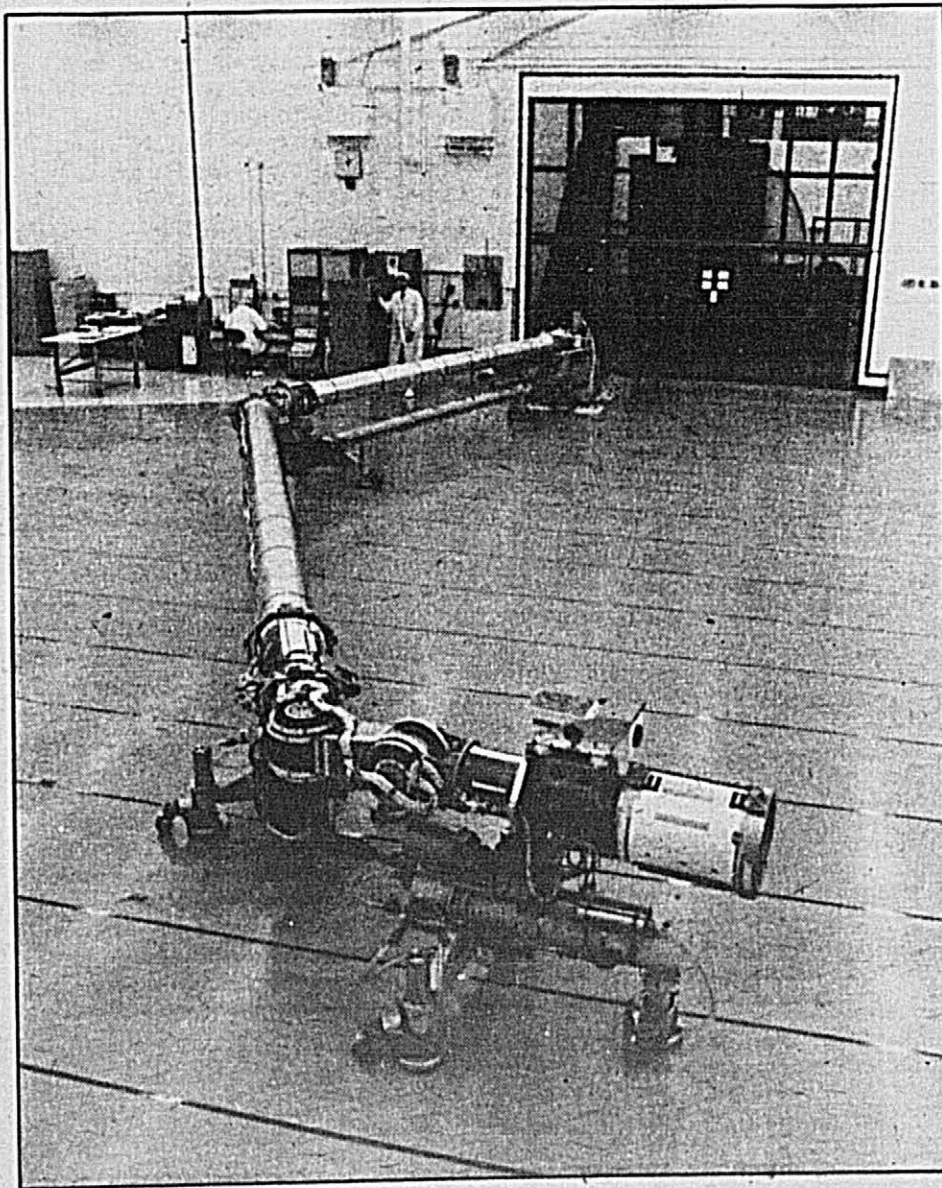
Using a knob in the left hand to control translational movement of the arm, and a control stick in the right (to point the end of the arm in pitch, yaw or roll), the astronaut controls the path and motion of the arm. The computer converts this input to the electrical impulses required to signal the appropriate arm responses, and computes and coordinates appropriate joint rotation rates and motor speeds. The arm is kept in the astronaut's view by several television cameras.

The size of the arm and its inability to operate fully unless under zero gravity, combined with the several delays in Shuttle test flights, mean that the RMS design is still untested. However, simulation testing has been an ongoing activity. This process involves complex computer modelling that incorporates variables that engineers and scientists involved in the project deem important. These mathematical models may be tested in a mock-up Space Shuttle flight deck, where an "astronaut" operates the controls based on computer-simulated pictures of the results of the "astronaut's" instructions. This sort of testing is not infallible, however.

At the Spar labs, the arm's ability has been tested on flat, nearly frictionless surfaces. So far, the results look good.

The RMS accomplishment means a lot more than just being able to launch satellites more efficiently. The design can be adapted for ocean floor pipeline repair jobs, cleaning up hazardous material spills, and working at Arctic drilling sites and mines — in short, the arm will be useful and marketable wherever there are hazardous jobs requiring superhuman strength and agility.

This incredible investment of time and energy has resulted in Canada becoming a front-runner in RMS technology. A fundamental question remains, however: could this talent and money have been better used to implement programs of more immediate social benefit here on earth?



In space, the arm will be capable of moving objects the size of a bus.

Photo / courtesy Spar Aerospace

DAILY SCIENCE ISSUE

Getting the bugs into biomass

by Bill Sheffield

At the University of Manitoba's Glenlea Research Station, alternative energy research is CRAP — the Calorific Recovery Anaerobic Process. The showpiece of the effort is a truck that runs on methane gas derived from pig manure.

Despite the Manitoba project's lighthearted name, biomass energy is a serious business. "Biomass" refers to matter that once lived and grew, and to the wastes it produced. Coal and gas on the other hand which come from organic matter that has been fossilized, are not included. While the directors of Exxon are not exactly trembling in fear of the new competition, biomass energy is the object of considerable current interest.

Long ago, biomass was practically the only source of energy for man, in the form of firewood. Today, researchers are looking at ways of treating biomass such as wood, excess crops, and manure, in order to produce combustible fuels like ethyl alcohol, methane, and hydrogen.

The North American public received its first taste of the potential of biomass energy when gasohol was introduced. The fuel is a mixture of 90% gasoline and 10% methanol. The ethanol used is produced through fermentation of crops or crop waste. In the U.S. Midwest, the fuel became popular as a way of using excess corn left over as a result of the grain embargo against the Soviets.

In Brazil, an alcohol made from sugar cane juice is used to make a 20/80 mix.

Critics have raised moral objections to the use of crops to make fuels, in a world in which a billion people are malnourished to some degree. No such criticism may be levelled at biomass programs that use wood or manure as a starting point.

At the National Research Council of Canada, researchers are working on the development of systems that convert cellulose, the principal ingredient of wood, into methane, the main constituent of the natural gas in Alberta pipelines. Drs. Wahee Khan and Girish Patel have discovered a form of bacteria called *Acetivibrio cellulolyticus*. This "bug" breaks down cellulose into

hydrogen (a possible fuel) and acetic acid. Treatment with another bacterium converts the acetic acid into methane and carbon dioxide. The catalyst the bacteria use to break up can be isolated and purified. It can then be used to produce the cellulose molecules, sugars from the cellulose; digestion

process control, the group is investigating the use of a sintered steel membrane. The membrane provides a surface to which the bacteria may adhere so that they will not be swept away by the outflow of products. In monitoring and control, experiments are being conducted with a computer-

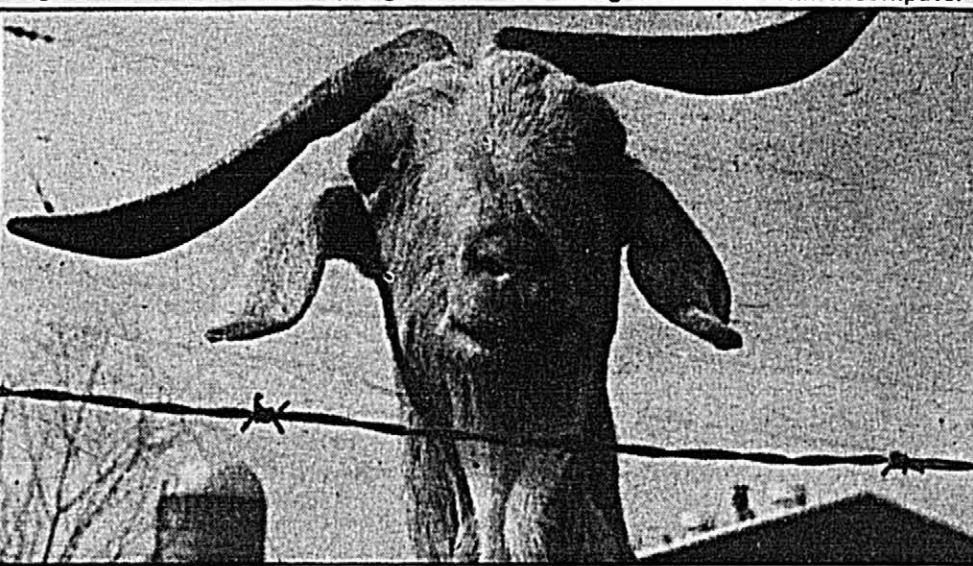
with the rotting wood.

In the Third World, biomass digesters called "Gobar plants" are in widespread use. A slurry of water and manure feeds into the digester, a concrete-domed structure that provides the anaerobic home of the bacteria that break down the manure. Methane gas is produced in the process, as well as rich organic fertilizer. India is a leader in the field, while China boasts seven million of the plants. Closer to home, in Colorado, Monford Industries has bought 100,000 head of cattle to provide the manure for its methane-producing fermentation process.

The link between energy production and biomass is often startling. Researchers at the University of Saskatchewan have come up with a means of producing oil from wood. The process involves mixing sawdust, water, and a catalyst, and subjecting the mixture to a high-pressure hydrogen atmosphere. A 1980 report indicated that wood oil comparable to high grade crude could be produced at a feasible cost, and yield 85% of the energy released by conventional oil.

Dr. Kelvin Ogilvie, of McGill's Department of Chemistry, sees the real promise of the microbial techniques used in biomass energy production in the making of synthetic enzymes. Since most industrial processes operate in two steps, they are less efficient than one step processes. Dr. Ogilvie points out the fact that if scientists possessed just the right enzyme that would convert starting material A into product B in one step, they would save enormous amounts of energy. One such enzyme, an epoxidase, has already been synthesized from scratch, using microbial factories and the techniques of genetic engineering.

It is a mistake to view biomass, or any alternative energy scheme, as a cure-all for the energy crisis. Research into its applications is paying dividends, but much work remains to be done. For the present, energy schemes involving biomass promise to provide clean, efficient energy from unlikely sources. In an unfolding patchwork quilt of different means of energy production, biomass promises to occupy an important portion of the fabric.



Dailyphoto/David Samuel

Next year's editor-in-chief? Hardly. It's biomass from livestock, an energy source that's been staring us in the face for years.

linked micro-processor that regulates the inflow of substrates and outflow of products. Finally, in metabolic control, researchers are attempting to force the bacteria to make only one product (butanol).

The contribution of biomass to the total energy picture need not always be in the production of fuels. Dr. Neufeld's work in producing much-sought-after industrial solvents from plant-derived sugars means that the fossil fuels ordinarily used as a starting material are conserved. Similarly, in the pulp and paper industry the use of wood wastes to fire boilers saves on oil. In Pitea, Sweden, a pulp and paper mill has just been completed that is completely self-sufficient in terms of fuel consumption. Waste wood and dried bark run the boilers of the process. Canada could profit from this example, since the pulp and paper industry is the single greatest consumer of oil in the country. The only problem with this approach is that it removes nutrients from the forest which would have returned to the soil

Dr. R. Neufeld, of McGill's Department of Chemical Engineering is working on a biomass fermentation process that produces industrial solvents like butanol and acetone as well as hydrogen and ethanol. The process employs sugars as a starting point, and relies upon *Clostridium acetobutylicum* to perform the required fermentation.

The research involves three areas. In

Hydrogen: Cheap, clean fuel of the future

by Heather Tisdale

In the near future, the world's energy will be dominated by electricity and hydrogen, according to Professor D.S. Scott of the University of Toronto.

Scott spoke at a seminar of mechanical and chemical engineers at McGill February 19.

"I think the media and the public should be more careful of its language," said Scott. "For instance, we do not have an energy crisis, we have an oil crisis."

Scott explained that hydrogen and electricity were currencies, not energy sources. A currency determines the nature of an energy transaction.

"We do not have a critical need for new energy sources, but we do need new curren-

cies," he said.

Because of depletion and the environmental effects, the world must depend less on its hydrocarbon (oil) sources and and depend more on non-hydrocarbon sources.

"Hydrogen is the only currency which can be reliably and universally manufactured by non-hydrocarbon sources," said Scott.

Liquid fuels would still be used for convenience, as it is not really viable to run a car on hydrogen.

Scott said that the fossil hydrocarbons had created immense problems of waste disposal.

"Acid rain costs Ontario \$500 million a year," he said.

The carbon dioxide levels of the world are going up, and Scott predicted that by the mid-

21st century, the energy balance of the world will have changed.

"Hydrogen presents difficulties because it can't be transported instantaneously," said Scott.

But the simultaneous use of electricity and hydrogen would balance out their shortcomings.

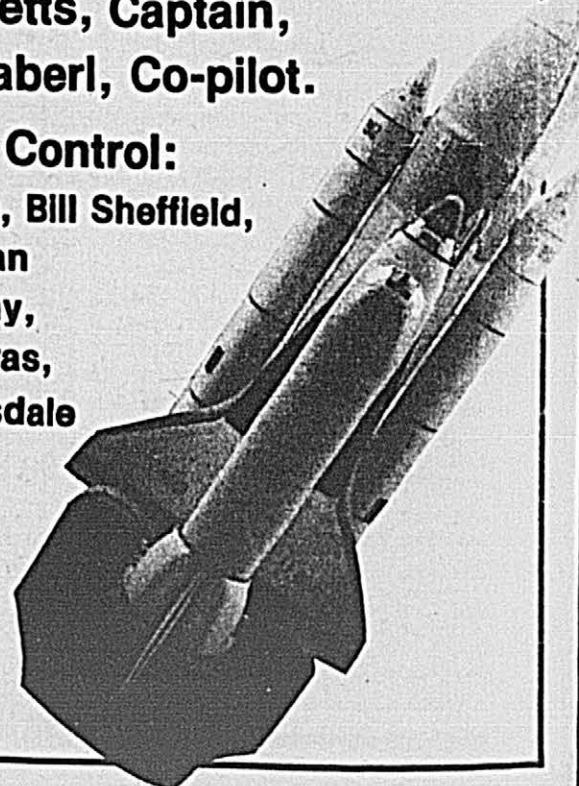
"We can use hydrogen effectively to extend the energy reserves we already have," said Scott.

"Knowing that we are able to utilize hydrogen and electricity allows us to shed our fear of the future," said Scott.

"The 21st century can be brighter environmentally and economically, and Canada has a great opportunity to lead the way."

Astronauts this flight:
Julian Betts, Captain,
Louise Haberl, Co-pilot.

Ground Control:
Bill Skarnes, Bill Sheffield,
Bev Akerman
Mike Murphy,
Marc Le Gras,
Heather Tisdale



Comment

The space shuttle: More than just a symbol

At a cost of \$9 billion, the space shuttle has been condemned as a frivolous excess of American pride. But in spite of its great symbolic value, the shuttle is no longer a luxury. The world has become dependent on satellites for international communications, weather and agricultural forecasts, monitoring of pollution, navigation and geological surveys. The shuttle will greatly reduce the cost of these services. The space program has also produced numerous side benefits such as miniaturized computers and calculators, which have singlehandedly revolutionized the rate of scientific progress.

Outer space holds incredible promise for humanity. As this Science Issue's articles show, solar-powered space factories using materials mined from the planets could put a permanent end to our search for new sources of energy and raw materials. The transfer of heavy industry far into space would preserve the earth's fragile environment, while freeing industry from the restraints of stringent anti-pollution legislation. Also, in the distant future, space civilization could conceivably alleviate the earth's population problems.

Are such predictions far-fetched? Perhaps. The huge cost overruns and frequent technical snags encountered by the space shuttle underline the immense difficulties inherent in space travel. But 100 years ago human flight seemed a technical impossibility. Today we find such a thought laughable. Similarly, 20 years ago the possibility of totally eradicating a human disease seemed "far-fetched." Now, in the case of smallpox, we seem to have done just that. Given time, human ingenuity will also transcend the economic barriers which now prevent space civilization.

Thus the long-term economic justification for the space

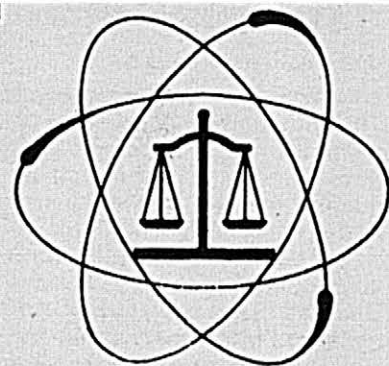
shuttle are great. But in our GNP-obsessed society, we sometimes forget that science is more than just a cog in the machinery of industry. Although scientists are always eager to emphasize the industrial applications of their work — particularly when applying for research grants — most of them do science not so much for its use to society, but simply because it is fun. And in this context, space is the ultimate playground.

Outer space may become a scientific playground, but there is an equal likelihood of its becoming a military battleground. As the article on the military and satellites indicates, the superpowers have begun gearing up for large-scale confrontations in space. The story about Space Law demonstrates that the use of outer space has already led to considerable international friction. When extraterrestrial colonies eventually become established, the probability of armed conflicts will rise dramatically. The new colonists may rebel against a social system imposed by another world, just as the American colonists did in 1775.

On the other hand, space colonization could bring about international cooperation on a scale which is now unthinkable, trivializing the nationalistic prejudices which divide the world.

Space colonies will develop in one of two ways. With careful planning now, space civilization could mark the blossoming of a new, more just society. But without active and vocal contributions from the public, space colonies will become merely a cancerous appendage of the earth, rife with the ills endemic in our present society. To a large extent, it is our generation which will decide which one of these two paths to follow into space. Let's not make any mistakes.

Julian Betts



Dear Students:

Are you interested in genetic engineering, the development of new weapon technologies, or the effects on society of new communication technologies? Are you concerned about Canada's support of research and development? In general, are you concerned about the role of science in our society?

If you answer is yes, you may wish to attend the first Canadian Student Pugwash Conference on "Science in Society: Its Freedom and Regulation" at Carleton University in Ottawa from June 12 through 14.

Sparked by a manifesto issued by Bertrand Russell and Albert Einstein, the first Pugwash Conference on Science and World Affairs was held in Pugwash, Nova Scotia in 1957. Canadian Student Pugwash continues this tradition by promoting the free discussion of science and ethics issues in the university community.

The first National Conference of Canadian Student Pugwash will bring together 50 students and 25 eminent senior participants from academic, research, legal, administrative, and business circles. The five workshops and two major public debates will focus on different aspects of the freedom and regulation of science. The published proceedings will include a selection of student and senior papers.

The following are the workshop topics: Society's Support of Scientific Activity; International Security and the Regulation of Defence Technology; Biological Research and the Manipulation of Life Forms; The Freedom and Regulation of Social Research; and, The Freedom and Regulation of Communication and Information Storage Technologies.

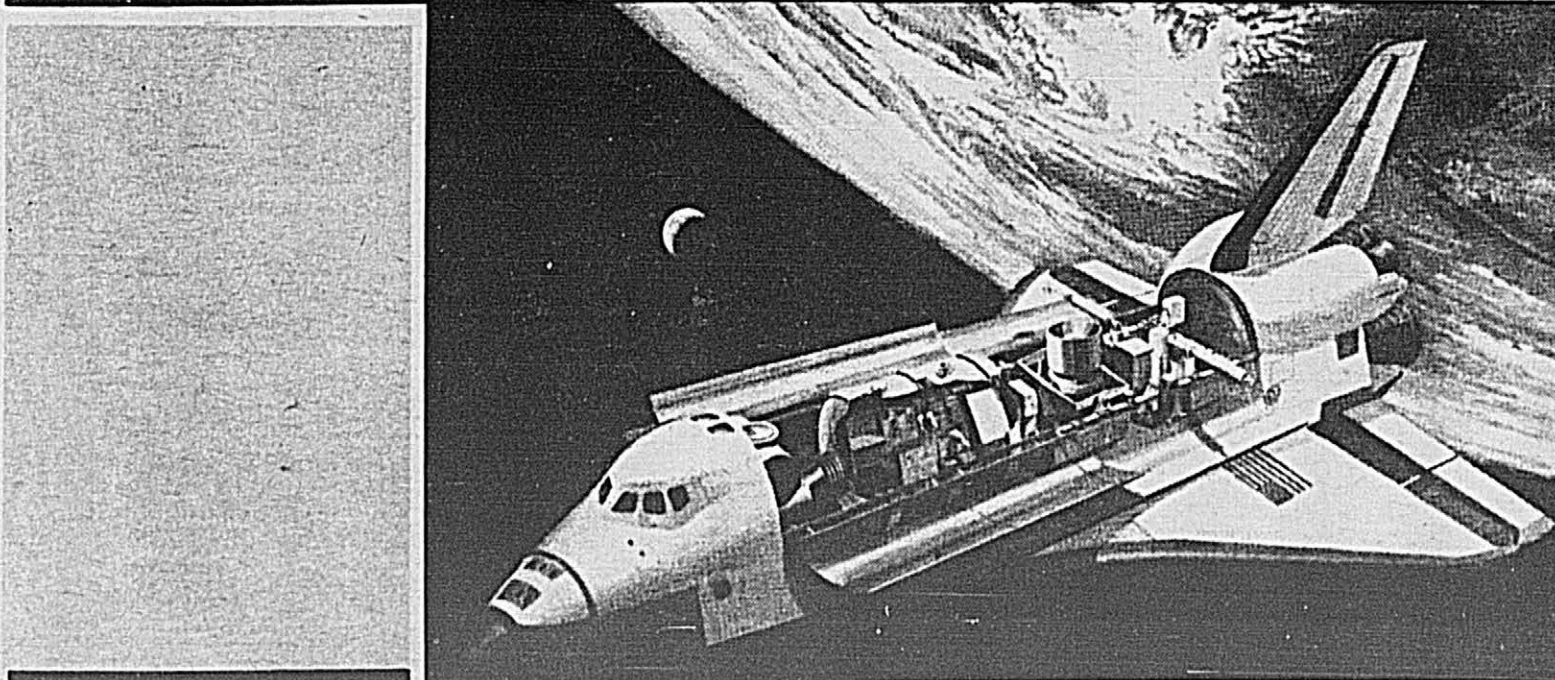
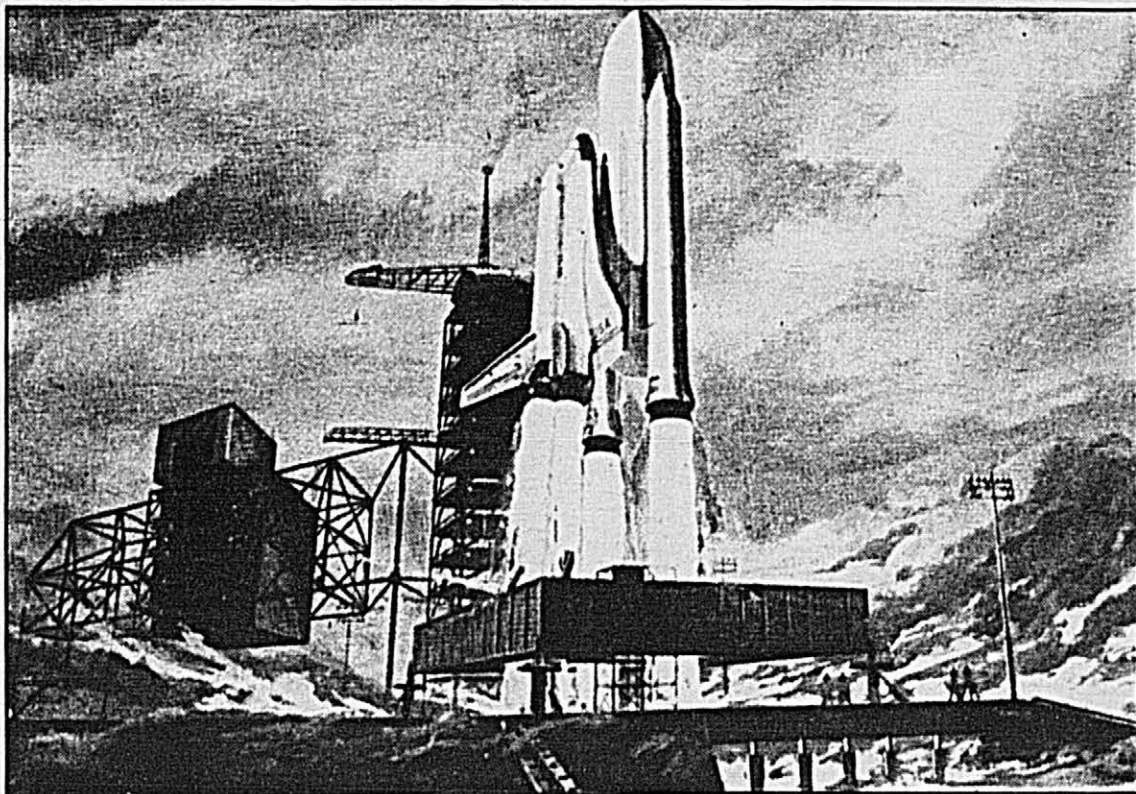
While in Ottawa, all costs for the student participants will be covered by Canadian Student Pugwash. We may also be able to provide some travel assistance.

If you are interested, brochures and applications for this conference should be available at any natural science, social science, or philosophy department at your university. If you cannot find this information, please write to me at No. 806-474 Wilbrod Street, Ottawa, K1N 6M9, and I will forward an application. Completed applications must be received in Ottawa by April 7.

Thank you.

Yours sincerely,

Fraser Homer-Dixon,
Conference Coordinator.



DAILY SCIENCE ISSUE

The Military....

continued from page 5

and highly intricate new technologies. The new strategic doctrines engendered by these technologies may cause governments to believe that limited nuclear war can be fought so that any nation may emerge the victor.

The major obstacle to an antisatellite accord between the U.S. and Soviet Union is the space shuttle, despite the Pentagon's assurances that the shuttle will not be used for antisatellite missions.

President Carter gave priority to curbs on such weapons. He had first raised the idea of controlling antisatellite systems early in his administration, but it was not until 1979 that the USSR indicated a similar interest.

However, the USSR tested a killer satellite in April of last year, breaking a two-year moratorium on testing of antisatellite weapons. The Soviet test was a failure, but American officials expressed concern for the safety of their military satellites.

It is clear that the American policy is one of continuing negotiations with the Soviets to ban these weapons, while developing an American antisatellite capability.

The American systems include ground-launched systems in which standard Minuteman III boosters would fire small homing antisatellites. Other blueprints involve spacecraft equipped with sensors that could examine an alien space vehicle and blow it up on command.

Lieutenant General Thomas Stafford, U.S. Air Force Deputy Chief of Staff told a defence subcommittee of Senate Appropriations: "I think a United States antisatellite capability is desirable. Space should not be exclusively a Soviet sanctuary." But when the military invades space, there is no sanctuary for anyone.

The following people are candidates in this week's elections for the Daily Editorial Board:

Editor-in-chief

Brahm Pascal

Brian Topp

Senior News Editor

Wendy Jones

Steven Yudin

News Editor

Chris Cavanagh

Peter Findlay

Kimberley Stephenson

Heather Tisdale

Sports Editor

Emily Earle

For co-editors:

Elise Goldberg & Bobby Katz

Photo Editor:

David Samuel

Features Editor

Peter Orr

Assistant Production Manager

Carlos J. Constantino

French Edition Editor

Lucie Masse

Science Edition Editor

Bill Sheffield

Weekly Editor

Richard Wesley-James

The following people were omitted from the list of voting staff members printed Monday: Lucie Masse, Bill Sheffield, Serge Beausoleil, Carleen Carroll, Ann Eaton, Francine Hébert, Peter Kooiman, Donald Matte, Claude Rémillard and John Roizin.

Screenings of candidates begin at 12:30 today. Balloting starts tomorrow at 10:00. Remember, democracy is more than just a vote. Attend the screenings and vote wisely.

Space industry is feasible...

continued from page 7

The space station would also act as a base for further space construction. NASA has contracts with Grumman to build an automated beam builder which would produce v-shaped aluminum girders of any desired length. For most applications in space, a girder does not have to be strong; all it requires is rigidity, which is supplied by the v-shape. This would contribute the basis for larger and more complex space stations.

Once industry was well-established in space there would be no limit to what could be accomplished. Dwindling

natural resources on earth would force us to look elsewhere. Raw materials could be obtained from the moon and the planets. It is known that Mars is rich in iron, the foundation of modern technology, and that Jupiter is surrounded by many gases, including hydrogen and methane. There also exists an asteroid belt which lies between the orbits of Mars and Jupiter. It contains between 30,000 to 40,000 small bodies, ranging in size from small moons to large boulders. These could easily be transported to positions closer to earth and mined.

Transportation around the solar system would not be a problem once out of the deep gravity wells of the earth. With current rocket technology, a one-mile diameter planetoid could conceivably be moved from its orbit between Mars and Jupiter to an orbit around the earth. As described

elsewhere in this issue, moons and planetoids could easily be mined by using electromagnetic devices, which would catapult small payloads off their surfaces and direct them towards receiving stations. Once an object attains a certain velocity in space, it will continue along at the same velocity forever unless another force acts upon it. Thus, the energy requirements for transport are minimal.

The solar system's resources are readily available, and the technology to make use of them can be created with a little imagination. The space shuttle can be considered as a catalyst for the inception of what is now termed the "third industrial revolution".

It is the prevailing philosophy of NASA that: "The earth is an island in space. People tend to prosper in proportion to how much they use the sea around them."

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Today

World Hunger Committee

Table in the Union today to promote the Nestle boycott, coffee house, (March 28), and fast, (March 25). Stop by, buy or sell a button, and do what you said you'd do for the coffee house.

Association of German Language Students

Important announcements today during the KLATSCH from 12:30-2pm. Elections, Work-student programs, and our special guest for this week "EIS". Come and practice your oral German before your exams.

Annual Watershow

29th Annual McGill Water Show Dress Rehearsal 7:15pm sharp. Currie Pool, 475 Pine Ave. West.

Camera Club

Nominations for Camera Club executive positions will be accepted today during office hours. Please hand in resumé of technical and other related experience.

Temple Emanu-el

Dr. Ruth K. Westheimer, Associate Professor of Psychiatry at Cornell University, noted lecturer and author of numerous articles in learned journals and medical textbooks on Human Sexuality, will speak on "Sexuality in the Jewish Tradition" at Temple Emanu-el - Beth Shalom, 4100 Sherbrooke St. W., at 8:00pm. The public is invited.

Film Screening

Chapayev, 1934, directed by the Vainilov brothers, inaugurates the new realism of the 1930s, combining heroism with vivid portraiture. FDA Auditorium, 6pm.

Comité de Solidarité Québec-Pologne

Conférence publique: De Kronstadt 1921 à Gdansk 1981. Pierre Vallières, Murray Bookchin et al. Pavillon Hubert Acquin (UQAM) (Métro Berri de Montigny): Salle 2885 à 20 heures.

Canadian Studies Students Association General meeting today in Rm 310 of the Union, at 4:00. Come help get the show on the road!

Hillel

Presents: Discover your roots! A 4-part lecture and discussion series on Contemporary Jewish Life and Perspectives, registration \$5.00. Today: The Culinary Art of Kashruth with Nina Glick 6:00pm.

Senate

McGill's Senate will be discussing divestment for the first time today in the Leacock Council Chambers room 820 at 2:00 pm.

McGill Comedy Club

Tonight is the all important final meeting of the term. Next year's events will be planned. Everyone is begged to attend. Place: Union room 107, Time: 7:00. The first 25 people to show up will receive free passes to next term's events; in case of people who have camped there overnight, straws will be drawn.

H.S.A. Films

"The Immigrant" starring Charlie Chaplin, "The Great Train Robbery" an early chase film, and "Our Northern Neighbour" an N.F.B. pro-communist movie from World War II will be shown in Leacock 15. Free Admission.

Colloquium

Mr. Stephen Heath, from Cambridge University, England-writer, film critic, semiologist and theoretician — will conduct a discussion on the present crisis in film criticism. 10am, in the Rattan Room Macdonald-Harrington Building, C208.

Community McGill

Special need for volunteer interested in working with prison inmate (presentation of movie and discussion). Come to our office for info Rm 406 Union 392-8937 12-2pm.

McGill Outing Club

Open meeting tonight at 7:30 in Union 310 featuring a slide show from the Andes, elections, banquet ticket sales and refreshments.

McPIRG

Organizing Committee meeting — McPIRG office, 5:30 pm. All board members must attend.

Les Belles Soeurs

This well-known play by Michel Tremblay will be performed in English according to the translation by John Van Burek and Bill Glasco. March 11, 12, 13, and 14 at 8pm in Moyse Hall, Arts Building (853 Sherbrooke St. W.). Admission \$3.00. Tickets available at the Union Box Office or at the door. For reservations, call 392-8926 (from 9-5pm).

H.S.A. Films

"The Immigrant" starring Charlie Chaplin, "The Great Train Robbery", an early chase film, and "Our Northern Neighbour", an NFB pro-communist movie from World War II will be shown at noon in Leacock 15. Free.

McGill teams do swimmingly

by Elise Goldberg

These Redmen and Martlets can never seem to get anywhere, right? The hockey teams didn't even make the play-offs and the basketball teams got knocked off in the first round. Doesn't McGill ever have a team in the Nationals?

Well, last Thursday, Friday and Saturday, four Redmen and four Martlet swimmers and one Martlet diver competed in the CIAU national championships in Toronto.

At present, not much is known about this year's swimming and diving team. Like all other teams at this university, this team faces a lack of good quality facilities and full-time coaching. The pool at the Currie Gymnasium is 25 yards in length and competitions and times are all done according to metric measurements. Coaches Harry Zarins and Lester Jackson are only part-time employees. There is no diving coach and the pool is not deep enough to practice three meter diving. This must be done at the Université de Montréal pool.

But this certainly didn't put a damper on the performance of the 1981 swimming and diving team. They came away with two gold and one bronze medal and both the Redmen and Martlets finished with an eleventh place ranking overall.

This year, the men's pride and joy is rookie Paul Crehan. Crehan won the bronze medal in the 200 meter breaststroke. In his other race, the 100 meter

breaststroke, he set a McGill team record with a time of 1:06.42.

The women's hope, backstroker Ginette Ladouceur, did not fare as well as had been hoped, but she did win the 100 and 200 meter consolation final races, placing seventh overall in both those races.

The men's 4 x 100 medley relay team of Rich Delahunty, Paul Crehan, Peter Neilley and Bill McCoy shattered the McGill team record of 4:06.55. The record had stood since 1972 but the 1981 team got their name in the books with a time of 4:05.32.

But the big news remains

with the diving results. McGill's representative to the diving team, Eniko Kiefer, won the gold medal in the one meter and the three meter diving competition. She also won the award for the Outstanding Female Diver of the meet.

But how did she do this when there's no diving coach?? Talent, that's for sure. And lots of practice at the U. de M. pool. Actually, Kiefer is an internationally known diver and is quite used to this kind of competition. And McGill is certainly lucky to have her here, considering the diving facilities available at the gym.

Runners trek to nationals

The McGill Track and Field team recently competed in the QUAA finals at Université de Laval in Quebec City.

Brenda Johnston and René Bélanger of McGill both won first place in their events to qualify for the Nationals.

Johnston led the women's 3,000 metre race with a final time of 10:04.9 minutes. She ran a well paced race taking the lead after the third lap and holding onto it for the remainder of the 15 lap race.

Johnston also finished second in the women's 1,000 meter race, behind Francine Gendron of UQAM who broke the Canadian record by one and one half seconds.

René Bélanger shot first place in the shot-put event with a distance of 14.37 metres.

The men's relay team composed of Tony Iachatta, Peter Churchill, Sam Stevens and Allan Tissenbaum placed second in a 4 200 relay race.

Tissenbaum also competed in the 60 metre sprints. He ran

well to finish second in the semi-finals and third in the finals. However he expressed his disappointment that the finals were held the day following the semi-finals.

"Most short distance runners perform their best on the second or third sprint on the same day," he said.

Long distance runners Danny Fitzgerald, Chris Adamopolis and Al Olha ran the men's 5,000 metre race. Fitzgerald led the pack and finished second.

Peter Churchill put in a strong performance to finish fifth in the men's 300 metre race. Tony Iachatta long jumped into fourth place with his best jump measuring 6.06 metres.

And in the 60 metre hurdles Sam Stevens finished third in his heat and went on to finish fifth in the finals.

Johnston and Belanger will be competing in the Canadian Track and Field Championships in Saskatoon March 13th and 14th.

The McGill Figure Skating Club

presents its

4th Annual

ICE SHOW

Date: Saturday, March 14

Time: 7:30 pm

Place: McConnell Winter Stadium Arena
(behind Molson Stadium)

Admission: \$1.25 tickets sold before Saturday
\$1.50 students, senior citizens
\$2.00 all others

Free public skating will follow the show.

Tickets can be purchased from the Union lobby
between noon and 1:00 pm on March 11 & 12,
or from
skating club members and performers in the show.

Ministries in the Roman Catholic Church

March 14

2:00 -
4:00 PM

The McGill Newman Centre will be holding a round table discussion of the options in the church for today's laity.



McGill Newman Centre
3484 Peel Street
392-6711

Why not stay for the Mass at 5:00 and the Saturday Night Supper at 6:30 after the discussion?

MEDICAL BLOOD DRIVE '81 continues... Today till Friday

**Free Beer
and Prizes every half hour**

**Coffee
and Doughnuts for all**

Every donor gets a free ticket for
"And Justice For All"
March 19th L132 7 & 9:30 pm

**Grand Prize:
Trip to England**
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Vacances par Wardair

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Roman Catholic Sexuality (Everything you wanted to know but were afraid to ask!)

A frank and open discussion on a variety of topics, including:

Intimacy	Commitment
Singles Sexuality	Dating
Engaged and Married Sexuality	
Pre-marital Sex	Gay Sexuality
Masturbation	Contraception

Coordinated by

Fr. Dick Sparks, moral theologian
from the Catholic University of America.

TONIGHT, 7:30 - 9:30pm



McGill Newman Centre
3484 Peel Street
392-6711

The McGill Film Society Presents

**TONIGHT
Macunaima**
7:00 & 9:30 L132

Thursday, March 12
Dersu Uzala
7:00 & 9:30 FDAA

Friday, March 13
Poetry and Film Conference
7:30 L132

Saturday, March 14
Nosferatu
7:00 & 9:30 FDAA
also
Poetry and Film Conference
7:30 L132

Students' Society Applications

are hereby called for the following appointed positions:
(Deadline: 4:30 p.m., Thursday, March 19, 1981)

BLOOD DRIVE CHAIRPERSON

Blood Drive '81 will be held during five days in October 1981 in the Union Ballroom. The Chairperson must choose a committee to oversee publicity, entertainment, door prizes, clinic volunteers, etc.

STUDENTS' SOCIETY CHIEF RETURNING OFFICER

The CRO will supervise Students' Society elections and by-elections during the 1981/82 school year. (Only individual applications will be accepted.)

JUDICIAL BOARD FIVE (5) MEMBERS

The Judicial Board of the Students' Society acts as the final authority on the interpretation of the constitution and by-laws as well as acts of Students' Council and any group recognized by Council. These five positions are open to law students who, during the 1981/82 academic year, will be in third or fourth year or pursuing a graduate degree. (Application forms available in the SAO and LUS offices. Only individual applications will be accepted for each position.)

OLD MCGILL EDITOR-IN-CHIEF

Old McGill is the hard cover, 350-page yearbook covering the entire school year. It will include photographs of all McGill graduates of that year as well as other relevant material as the Editor sees fit.

OMBUDSMAN

This position, established by the Students' Society Constitution, serves as a means by which students can obtain help in cutting through McGill bureaucracy at all levels and to inform students of the proper channels to air grievances.

SOUTH AFRICA COMMITTEE CHAIRPERSON

The External Affairs Committee on South Africa was established by Students' Council to carry out two primary functions. These are: to educate the student body about the situation in South Africa and to urge the University to divest its funds from companies operating in South Africa and from banks extending loans to South African institutions. The Chairperson assumes a general coordinating role and ensures that the three sub-committees operate effectively.

STUDENT HANDBOOK EDITOR-IN-CHIEF

The Handbook will be given to every student at McGill during registration in September 1981. The book will include introductory material about McGill, Montreal, the Students' Society and other campus groups.

NOTE:

All of the above positions are considered voluntary. In some cases, however, small honoraria or part-time employment pay is involved. Except as noted above, joint applications will be accepted from not more than two (2) students for any one (1) position. All applications will be treated confidentially and will be reviewed by the Students' Society Nominating Committee. The best qualified candidates will likely be interviewed by the committee.

Mary-Louise Prosen, Chairperson
Students' Society Nominating Committee

PROGRAM BOARD CHAIRPERSON

For the 1981/82 year, the Students' Society and Student Services jointly agreed to centralize the major entertainment-oriented committees at McGill under one chairperson. This will include: Welcome Week, Activities Night, the existing Program Board, the guest speakers program and Winter Carnival.

The Chairperson of this new committee will have general responsibility for the planning and carrying out of all of the above-named activities. He or she will also be involved in the selection of students to fill the following additional positions on the Board: Treasurer, Vice-Chairperson (Publicity), V-C (Welcome Week), V-C (General Programs), V-C (Speakers) and V-C (Winter Carnival). Applications for these positions will be called for in the near future.

(Only individual applications will be accepted.)

RAEU THREE (3) REPS

Under the general supervision of the Vice-President, External Affairs of the Students' Society, these McGill representatives help to ensure that the Regroupement des associations étudiantes universitaires du Québec (Federation of University Student Associations of Quebec) remains an effective voice of university students in Quebec, especially in its dealings with all levels of government and university administrations. Applicants should have a good working knowledge of the French language and be prepared to attend RAEU council meetings about every three weeks. (Note: RAEU headquarters are located in the McGill Student Union; however, meetings are held occasionally on other Quebec university campuses. (Only individual applications will be accepted for each position.)

SECOND-HAND BOOKSALE COORDINATOR

The Students' Society will sponsor a second-hand booksale in September (and possibly one in January). The Coordinator must organize these sales which includes publicity and finding student staff. (The Students' Society encourages applications from individuals representing particular campus groups which could provide group members as volunteers.)

STUDENTS' SOCIETY NEWSLETTER

EDITOR-IN-CHIEF

The Students' Society intends to publish at least monthly issues of its Newsletter during the 1981/82 academic year. The Newsletter will be a tabloid-sized newspaper with the purpose of informing the members of the Students' Society of campus issues, events and activities. The Editor-in-Chief will oversee the publication and coordinate the volunteer staff.

"General Application" forms are available from the Students' Society General Office, Room 105 of the Student Union, 3480 McTavish Street, from Sadie's II in the McConnell Engineering Building or in Chancellor Day Hall from the SAO or LUS offices.

Completed applications must be submitted to Leslie Copeland, Operations Secretary, Students' Society General Office **NO LATER THAN 4:30 P.M., THURSDAY, MARCH 19th, 1981.**

